

MARKET POTENTIAL

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Students from Weber State University Department of Construction & Building Sciences made up the senior project team representing departments:

- Building Design & Construction
- Interior Design
- Construction Management

Our team constructed the all-electric home they designed, in collaboration with Ogden City, on the corner of 28th street and Quincy Avenue in Ogden Utah.

The 2,540 total square foot home (1270 on main and 1270 finished basement) incorporates portable battery backup technology to allow the home to maintain critical loads for up to 72 hours if the electrical grid were to be down in a natural disaster or emergency. Not only does the Solar Array generate enough energy to offset the energy usage of the home annually, it also generates enough electricity to charge an electric vehicle to travel 20 miles per day. Occupants are able to monitor their usage via Solar Edge App and Emporia Vue app, helping users understand their energy consumption.



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The lot was donated by Ogden City to show their commitment to revitalizing neighborhoods and breath new life into historic districts. Many lots like this dot Ogden City making this build easily replicable.

This particular lot sat empty for nearly 10 years after a dilapidated 4-plex was torn down. The Craftsman Architectural Style home was intentionally designed to nestle in nicely with other homes on this historical avenue and showcase how a period style home can provide a net-zero energy lifestyle.



Students worked with city planners to design a home that would fit on the narrow deep lot. The home was designed at 24' wide x 58' deep with a detached garage. Students were provided a set of plans that the city planners had initiated and collaborated with us to alter to meet criteria set per Solar Decathlon competition requirements.

The design was dictated by the setback of the lot. It was a very difficult lot to build on because of it being a corner lot and having 20' setbacks from the back side of the existing sidewalks. A 6' setback on the west side required that windows be strategically placed so they didn't look directly into windows of the neighbors.

We discovered that the "free" lot that was donated by the city had a long list of issues. The debris from the old four plex had been buried on site and we spent an additional \$20,000 hauling it away along with some dead trees and substantial root networks that required removal. An underground aquifer that ran through the site just a few inches below our footings which necessitated the installation of a perimeter and partial French drain that cost an additional \$2,500.

We were required to replace all of the exiting sidewalk, curb, gutter, and existing driveway approaches left over from the four plex which cost an additional \$25,000. The sewer lateral was only 4' below grade even though we were told it was deep enough to allow a gravity fed plumbing connection and therefore had to install an ejector pump to the cost of nearly \$3,500. We were required to install new sewer and water laterals across the adjacent street which cost nearly \$18,000.

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From the street, other than the solar panels, there is no distinct differentiation that this house is a net positive, all electric home. Capable of producing all of its own energy annually and maintaining all of its critical loads in excess of a week, this home also charges an electric car to drive up to 20 miles per day in the detached garage. This was on purpose! We wanted to prove that you can build a net zero home without it "sticking out" in order to appeal to a broad audience. Average size of single family house along the Wasatch Front is 2200 sq. ft. Our home meets the demands of large families, multi-generational families and potential AHU opportunities.



We designed large overhangs to nearly eliminate solar heat gain in the summer due to shade angles. We maximized the windows on the East side to allow solar heat gain in the winter, but limited the west facing windows and eliminated all windows on the south to minimize solar heat gain during the summer.



A view of the picturesque Rocky Mountains is to the East. All of the living space were intentionally placed on the East side of the home in conjunction with large windows to allow ample daylight and a view of the stunning sunrises and sunsets.

All potential buyers who walked through the home commented on how much bigger it felt than it appeared from the exterior. We knew we were successful when the sub-contractors, who were working on the build, started asking if they could buy the home.



The home is long and narrow, therefore long site lines were designed to allow the feeling of a more open floor plan. All upstairs hallways were eliminated to open up the spacious feel of the floor plan and to accommodate for ADA accessibility.

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The home is designed to make the “True Cost of Ownership” affordable to occupants of the east bench sector of Ogden by nearly eliminating all energy bills. It is estimated that the energy costs to operate the home will be just over \$100 annually or around \$9 per month to be connected to the electrical grid. The electrical grid essentially acts like a battery.

Excess energy not being used by the home during the day or on sunny day is put back on the grid for other neighbors and businesses to use, then the reverse is true when the home requires more energy than the solar array is producing, such as in the evening or on shady days. The net result of energy export and import is net-zero annually.

The home showcases technology such as Variable Refrigerant Flow HVAC, Air Source Heat Pump Water Heating, and Energy Recovery Ventilation to keep the super insulated and airtight home continuously sourced with fresh pre-conditioned air.

The building envelope of the home showcases off-the-shelf solutions that requires the super-efficient HVAC to only heat or cool the air within the home less than once an hour where most new homes today require the air to be conditioned 4-7 times per hour.

The foundation is built with Insulated Concrete Forms (ICFs) that have an effective R-Value of 45-55 and the main floor walls are panelized Structural Insulated Panels (SIPs) that have an effective R-Value of 27-29. Having SIPs produced off site fast tracked the build, ensured quality control during manufacturing and potential replicability.

The roof utilizes Raised Heel Energy Trusses to allow the full depth R-49 insulation in the attic to be extended all the way out to the edge of the exterior walls. This helps to maintain conditioned air inside the home as well as prevent the leading cause of ice dams on homes in Utah.



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The color selection was reversed on the inside of the home to allow off white walls to be painted with a semi-gloss paint while applying color to the trim and doors. This allowed the natural light coming in from the large east facing windows to reflect off the paint sheen and flood the main floor.

The oversized basement windows allowed the same so there is no need to have artificial light during the day. These large windows help connect the occupant with the outdoors while also allowing for cross ventilation in the spring and fall to passively heat and cool the home.

We specified dark laminate vinyl planks throughout the main level to absorb solar heat gain and maximize the thermal mass advantages.

All efforts were made to use recycled materials, no VOC's, long life and energy efficient products. Cradle to cradle LVP was installed upstairs, along with budget friendly wool carpet.

The home is 100% LED fixtures with only the bathroom vanity lights requiring light bulbs.

We intentionally did not specify any materials that were not readily available in our local market. All products were sourced from big box stores, distributors or local hardware stores.



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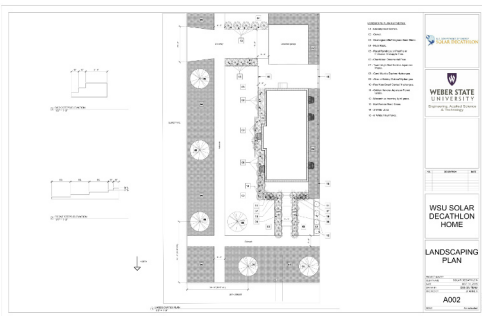
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The yard was originally designed to be xeriscaped due to Utah being the 2nd driest state in the United States. However, this proved to be more expensive than estimated and didn't fit our affordability criteria for the project.

Drought tolerant sod was installed along with a digitally controlled, low flow, irrigation system. This particular sod is a "warm weather fescue grass mix", and requires 70% less water than traditional Kentucky bluegrass sod, often found in the Intermountain West as the only choice for landscapes. We sourced this turf grass from a family farm 130 miles North of Ogden.

Gravel and bark were placed on the west and south ends of the home and garage to reduce irrigation requirements.

All planter areas use drought tolerant, native plants and are irrigated with a drip system. Bark was placed over the top to help retain moisture and minimize evaporation.



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Thirteen full price offers were received within the two week window that the house was on the market. A "opportunity drawing" was held where the President of the University drew, at random, the new owners.

Many developers and local builders toured the property as it was being built and during the open house phase. One party, in particular, was working with an adjacent city to permit 50+ net zero, single family, homes. Due to the strong economy in Utah, housing prices have increased 24% over last year. Low inventory, high demand and below average mortgage rates are factors effecting the housing market statewide.



This house has the potential to offer affordable building solutions to the growing Utah housing market through immediate and/or long term impacts by efficient build techniques, materials and long term utility savings.

The ability to mass produce this house is high due to is pre-manufactured parts, simple design and off the shelf HVAC and photovoltaic system, positively impacting the US residential energy efficiency efforts and renewable industry sectors.

Our home sold November 13, 2020 at above median sales price for 2020. Comparables in the area indicate this home could have sold for \$173.00 sq. ft. - \$261.00 sq. ft. or:

\$439,420 - \$662,940

Out of pocket expenses to build this home was \$314,595.46.

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Construction Costs



\$199,423.42 in donations

\$314,595.46 out of pocket expenses

Donations:

\$123,267.80... Gift in Kind

\$27,854.00 ... Student/Faculty Sweat Equity

\$43,301.62 ... Ogden City

\$20,000 ... Wadman Corporation

Cost per square foot:

2540 finished square feet:

\$147.51 ... cost per SF

Comparables:

Average new build construction costs for Ogden Utah: \$175 per SF.

Medium list price per SF in Utah (Realtor.com 2/20/21): \$241 per SF.

Average SOLD price the State of Utah (MLS 2/20/21): \$497,251

True Value:

True value per square foot: **\$207.76 including all donations and sweat equity.** The true value of the Net Zero house was \$509,018.88

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UtahRealEstate.com - Column Report - Residential

				
Ref #:	1702345	1706503	1715851	1719172
MLS#:	09/18/2020	10/09/2020	12/08/2020	01/08/2021
Entry Date:	Sold	Sold	Sold	Sold
Status:	no	no	no	no
UnderConst:	\$345,000	\$379,000	\$408,900	\$419,900
List Price:	\$135.83	\$175.46	\$188.78	\$193.24
Price/Sq Ft:	Single Family	Single Family	Single Family	Single Family
Type:	Bungalow/Cottage	2-Story	2-Story	2-Story
Style:	2807	3452	2133	2125
House #:	QUINCY AVE	ECCLES AVE	PORTER AVE	PORTER AVE
Street:				
Unit #:	Ogden	Ogden	Ogden	Ogden
City:	UT, 84403	UT, 84403	UT, 84401	UT, 84401
State,Zip:	OGDEN CITY SURVEY		STONE HILL	STONE HILL
Proj/Subdiv:		SE		
Quadrant:		3452		
North/South:		1050		
East/West:	02-011-0061 • History	05-044-0061 • History	01-117-0004 • History	01-117-0003 • History
Tax ID:	6	4	4	4
Tot Beds:	2.00	3.00	3.00	3.00
Tot Bath:	0	0	0	0
Fireplace:	2	1	1	1
Tot Family:	0	0	0	0
Lev4sqft:	0	0	0	0
Lev3sqft:	0	0	0	0
Lev2sqft:	0	1080	1279	1254
Lev1sqft:	1270	1080	887	919
BsmFtFin%:	1270/95	0/-	0/0	0/0
Tot SqFt:	2,540	2,160	2,166	2,173
Gar/Port:	2/0	2/0	2/0	2/0
Deck/Patio:	0/0	0/0	0/1	0/1
Exterior:	Clapboard/Masonite	Cement Board, Vinyl	Brick; Clapboard/Masonite; Stone	Brick; Clapboard/Masonite; Stone
Roof:	Asphalt Shingles	Asphalt Shingles	Asphalt Shingles	Asphalt Shingles
Heating:	Electric; Active Solar; >= 95% efficiency	Forced Air; Gas: Central	Forced Air; Gas: Central; Gas: Stove; >= 95% efficiency	Forced Air; Gas: Central; >= 95% efficiency
AirCond:	Central Air; Electric; Active Solar	Central Air; Electric	Central Air; Electric	Central Air; Electric
Water:	Culinary	Culinary; Secondary	Culinary	Culinary
Utilities:	Power: Connected; Sewer: Connected; Water: Connected	Gas: Connected; Power: Connected; Sewer: Connected; Water: Connected	Gas: Connected; Power: Connected; Sewer: Connected; Sewer: Public; Water: Connected	Gas: Connected; Power: Connected; Sewer: Connected; Sewer: Public; Water: Connected
Acres:	0.13	0.18	0.16	0.16
Est. Taxes:	1	683	1,400	1,400
HOA Fee:	\$0	\$0	\$0	\$0
Year Built:	2020	2020	2020	2021
Zoning:	2	2	2	2
CDOM:	24	24	13	7
DOM:	24	24	13	7
Sold Date:	11/13/2020	12/9/2020	1/8/2021	2/10/2021
Sold Price/Sq Ft Inc Lot:	\$135.83	\$173.61	\$188.78	\$193.24
Sold Price:	\$345,000	\$375,000	\$408,900	\$419,900

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State is Utah • Status is Sold or Active • City is Weber County or Ogden • Number of Days Back at most 180 days back
 • Property Type is Single Family • Year Built at least 2019 • Total Square Feet at least 2000 • Total Square Feet at most 2800

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